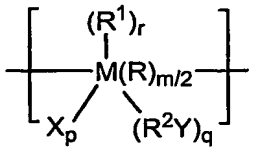
CLAIMS

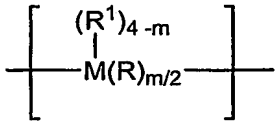
1. A polymer comprising a structural unit (1)



(1)

wherein R is individually selected from divalent hydrocarbon radicals;
R^1 is selected from the group consisting of monovalent hydrocarbon radicals, organic polymers and inorganic polymers;
R^2 is individually selected from divalent hydrocarbon radicals;
M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin;
X is selected from H, Cl, Br and I;
Y is selected from H, Cl, Br and I;
m is an integer of 1 or 2;
p is an integer of 1 or 2;
q is an integer of 1 or 2;
r is an integer of 0 or 1; and,
wherein $m+p+q+r = 4$.

2. A polymer comprising a structural unit (2)



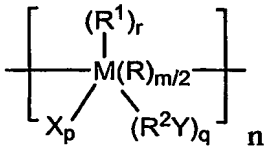
(2)

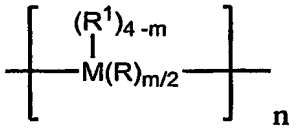
wherein R is individually selected from divalent hydrocarbon radicals;
R^1 is selected from the group consisting of monovalent hydrocarbon radicals, H, Cl, Br, I, organic polymers and inorganic polymers;

M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin; and,
m is an integer of 1-4.

3. A polymer according to claim 1, wherein the polymer is a hydrogenation catalyst when X is H.

4. A polymer according to any one of the preceding claims, comprising one or both of the following structures





wherein n is an integer of 10-100000, more preferably 50-50000, more preferably 200-10000.

5. A polymer according to any one of the preceding claims, wherein R is selected from the group consisting of C_{1-20} alkanediyl, C_{2-20} alkenediyl, C_{2-20} alkynediyl, C_{3-30} cycloalkanediyl, C_{3-30} cycloalkenediyl, C_{5-30} cycloalkynediyl, C_{7-30} alkarylenediyl and C_{5-30} arylenediyl, any of which may be optionally substituted with one or more heteroatoms in the carbon backbone.

6. A polymer according to any one of the preceding claims, wherein R is selected from the group consisting of C_{1-15} alkanediyl, C_{2-15} alkenediyl, C_{2-15} alkynediyl, C_{4-20} cycloalkanediyl, C_{4-20} cycloalkenediyl, C_{5-20} cycloalkynediyl, C_{7-20} alkarylenediyl and C_{6-20} arylenediyl, any of which may be optionally substituted with one or more heteroatoms in the carbon backbone.

7. A polymer according to any one of the preceding claims, wherein R is selected from the group consisting of straight chain C_{1-15} alkanediyl, C_{2-15} alkenediyl and C_{6-15} alkarylenediyl, preferably 1,6-hexylene, 1,8-octylene, 1,10-decylene and 1,12-dodecylene.

8. A polymer according to any one of the preceding claims, wherein substantially all groups R are the same.

9. A polymer according to any one of the preceding claims, wherein R^1 is selected from the group consisting of C_{1-20} alkyl, C_{1-20} alkoxy, C_{2-20} alkenyl, C_{2-20} alkynyl, C_{3-30} cycloalkyl, C_{3-30} cycloalkenyl, C_{4-30} cycloalkynyl, C_{7-30} alkaryl, C_{5-30} aryl, C_{5-30} aryloxy, any of which may be optionally substituted with one or more heteroatoms in the carbon backbone, organic and inorganic polymers.

10. A polymer according to any one of the preceding claims, wherein R^1 is selected from the group consisting of C_{1-15} alkyl, C_{1-15} alkoxy, C_{2-15} alkenyl, C_{2-15} alkynyl, C_{3-20} cycloalkyl, C_{3-20} cycloalkenyl, C_{4-20} cycloalkynyl, C_{7-20} alkaryl, C_{6-20} aryl, C_{6-20} aryloxy, any of which may be optionally substituted with one or more heteroatoms in the carbon backbone, organic and inorganic polymers.

11. A polymer according to any one of the preceding claims, wherein R^1 is selected from the group consisting of straight chain C_{1-10} alkyl, C_{1-10} alkoxy, C_{2-10} alkenyl, C_{6-12} aryl, C_{6-12} aryloxy and organic polymers.

12. A polymer according to any one of the preceding claims, wherein R^1 is selected from the group consisting of methyl, ethyl, propyl, butyl, hexyl, cyclohexyl, octyl, nonyl, dodecyl, eicosyl, norbornyl and adamantyl, vinyl, propenyl and cyclohexenyl, benzyl, phenylethyl and phenylpropyl, phenyl, tolyl, dimethylphenyl, trimethylphenyl,

ethylphenyl, propylphenyl, biphenyl, naphthyl, methylnaphthyl, anthryl, phenanthryl, benzylphenyl, pyrenyl, acenaphthyl, phenalenyl, aceanthrylenyl, tetrahydronaphthyl, indanyl, biphenylyl, methoxy, ethoxy, propoxy, butoxy, pentoxy, hexoxy, phenoxy, 1,2-dimethylbutoxy, preferably phenyl and phenoxy.

13. A polymer according to any one of the preceding claims, wherein R^2 is selected from the group consisting of C_{1-20} alkanediyl, C_{2-20} alkenediyl, C_{2-20} alkynediyl, C_{3-30} cycloalkanediyl, C_{3-30} cycloalkenediyl, C_{5-30} cycloalkynediyl, C_{7-30} alkarylenediyl and C_{5-30} arylenediyl, any of which may be optionally substituted with one or more heteroatoms in the carbon backbone.

14. A polymer according to any one of the preceding claims, wherein R^2 is selected from the group consisting of C_{1-15} alkanediyl, C_{2-15} alkenediyl, C_{2-15} alkynediyl, C_{4-20} cycloalkanediyl, C_{4-20} cycloalkenediyl, C_{5-20} cycloalkynediyl, C_{7-20} alkarylenediyl and C_{6-20} arylenediyl, any of which may be optionally substituted with one or more heteroatoms in the carbon backbone.

15. A polymer according to any one of the preceding claims, wherein R^2 is selected from the group consisting of straight chain C_{1-15} alkanediyl, C_{2-15} alkenediyl and C_{6-15} alkarylenediyl, preferably 1,6-hexylene, 1,8-octylene, 1,10-decylene and 1,12-dodecylene.

16. A polymer according to any one of the preceding claims, wherein X is individually selected from the group consisting of Br, I and H, most preferably Br and H.

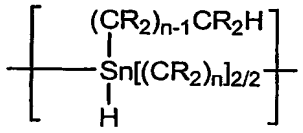
17. A polymer according to any one of the preceding claims, wherein Y is individually selected from the group consisting of Br, I and H, most preferably Br and H.

18. A polymer according to any one of the preceding claims, wherein X' is Cl.

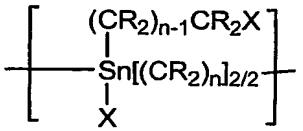
19. A polymer according to any one of the preceding claims except claim 2, wherein p is 1.

20. A polymer according to any one of the preceding claims except claim 2, wherein q is 1.

21. A polymer according to any one of the preceding claims except claim 2, comprising a structural unit (7) and/or (8)



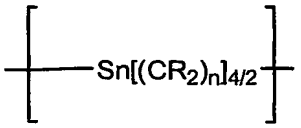
(7)



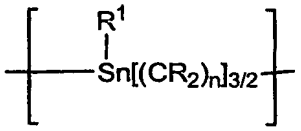
(8)

wherein R is individually selected from the group consisting of H, methyl and propyl, preferably H;
X is Br or I; and,
n is an integer of 1-20, preferably 1-12, more preferably 6, 8, 10, or 12.

22. A polymer according to any one of the preceding claims except claim 2, comprising a structural unit (9) and/or (10)



(9)



(10)

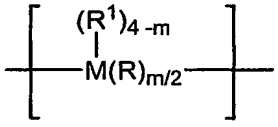
wherein R is individually selected from the group consisting of H, methyl and propyl, preferably H;

R^1 is selected from the group consisting of C_{6-10} aryl and C_{6-10} aryloxy, preferably phenyl and phenyloxy; and,

n is an integer of 1-20, preferably 1-12, more preferably 6, 8, 10, or 12.

23. A polymer according to any one of the preceding claims, wherein the molecular weight of the polymer is in the range of 100-10000000, more preferably in the range of 1000-1000000, more preferably in the range 10000-100000.

24. A process for the production of a polymer comprising a structural unit (2)



(2)

wherein R is individually selected from divalent hydrocarbon radicals;

R^1 is selected from the group consisting of monovalent hydrocarbon radicals, H, Cl, Br, I, organic polymers and inorganic polymers;

M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin; and,

m is an integer of 1-4; comprising reacting a diGrignard reagent having the formula (3)

$$XM'(R)M'X \qquad (3)$$

wherein X is individually selected from the group consisting of Cl, Br and I;

M' is individually selected from the group consisting of Group II metals; and,

R is selected from divalent hydrocarbon radicals;

with a compound having the formula (4)

$$R^1{}_aMX'_b \qquad (4)$$

wherein R^1 is selected from the group consisting of monovalent hydrocarbon radicals, H, organic polymers and inorganic polymers;

M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin;

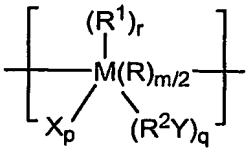
X is individually selected from the group consisting of Cl, Br and I;

X' is individually selected from the group consisting of Cl, Br and I;

a is an integer of 0-2; and,

b is an integer of 2-4.

25. A process for the production of a polymer comprising a structural unit (1)



(1)

wherein R is individually selected from divalent hydrocarbon radicals;

R^1 is selected from the group consisting of monovalent hydrocarbon radicals, organic polymers and inorganic polymers;

R^2 is individually selected from divalent hydrocarbon radicals;

M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin;

X is selected from Cl, Br and I;

Y is selected from Cl, Br and I;

m is an integer of 1 or 2;

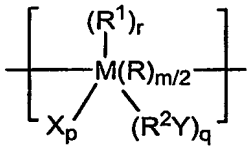
p is an integer of 1 or 2;

q is an integer of 1 or 2;

r is an integer of 0 or 1; and,

wherein $m+p+q+r = 4$; comprising reacting a compound having formula (2) as defined in claim 24 with a compound selected from a chlorinating agent, a brominating agent and an iodinating agent.

26. A process for the production of a polymer comprising a structural unit (1)



(1)

wherein R is individually selected from divalent hydrocarbon radicals;

R^1 is selected from the group consisting of monovalent hydrocarbon radicals, organic polymers and inorganic polymers;

R^2 is individually selected from divalent hydrocarbon radicals;

M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin;

X is selected from H, Cl, Br and I;

Y is selected from H, Cl, Br and I; with the proviso that at least one of X or Y is H;

m is an integer of 1 or 2;

p is an integer of 1 or 2;

q is an integer of 1 or 2;

r is an integer of 0 or 1; and,

wherein $m+p+q+r = 4$; comprising reacting a polymer comprising a structural unit (1), wherein X and Y are selected from Cl, Br and I, with a reducing agent that is a hydride source.

27. A process according to claim 24, wherein M' is selected from magnesium or calcium, most preferably magnesium.

28. A process according to claim 24, wherein a is 0 or 1.

29. A process according to claim 24, wherein b is preferably 3 or 4.

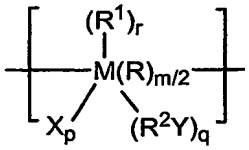
30. A process according to claim 25, wherein the chlorinating, brominating and iodinating agents are Cl_2, Br_2, I_2 respectively.

31. A process according to claim 26, wherein the reducing agent is selected from the group consisting of borohydrides, aluminium hydrides and/or boranes; preferably lithium aluminium hydride, sodium borohydride, sodium hydride, boranes, selectride, lithium borohydride, sodium cyanoborohydride, sodium naphthelenide, DIBAL-H and/or REDAL-H.

32. A process according to claim 26, wherein the reduction reaction is facilitated with a radical initiator, preferably selected from the group consisting of 2,2'-azobisisobutyrpnitrile (AIBN), benzoyl peroxide, tert-butyl peracetate, peracetic acid, tert-amyl peroxybenzoate, tert-butylperoxide and cyclohexanone peroxide.

33. A process comprising two or more of the processes according to claims 24, 25 and 26.

34. A process for the production of a polymer comprising a structural unit (1)



(1)

wherein R is individually selected from divalent hydrocarbon radicals;
R' is selected from the group consisting of monovalent hydrocarbon radicals, organic polymers and inorganic polymers;
R^2 is individually selected from divalent hydrocarbon radicals;
M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin;
X is selected from H, Cl, Br and I;
Y is selected from H, Cl, Br and I; with the proviso that at least one of X or Y is H;
m is an integer of 1 or 2;
p is an integer of 1 or 2;
q is an integer of 1 or 2;
r is an integer of 0 or 1; and,
wherein $m+p+q+r = 4$,
comprising the steps of:
(i) reacting a diGrignard reagent having the formula (3)

$$XM'(R)M'X \qquad (3)$$

wherein X is individually selected from the group consisting of Cl, Br and I;

M' is individually selected from the group consisting of Group II metals; and,

R is selected from divalent hydrocarbon radicals;

with a compound having the formula (4)

$$R^1_aMX'_b \qquad (4)$$

wherein R^1 is selected from the group consisting of monovalent hydrocarbon radicals, H, organic polymers and inorganic polymers;

M is a tin, silicon or germanium atom, preferably tin or silicon, more preferably tin;

X is individually selected from the group consisting of Cl, Br and I;

X' is individually selected from the group consisting of Cl, Br and I;

a is an integer of 0-2; and,

b is an integer of 2-4;

(ii) reacting the product of step (i) with a compound selected from a chlorinating agent, a brominating agent and an iodinating agent; and,

(iii) reacting the product of step (iii) with a reducing agent that is a hydride source.

35. Use of a polymer according to any of claims 1 to 23, in catalysis, preferably hydrogenation catalysis.

36. A product obtainable by a process according to any of claims 24 to 34, or a combination thereof.

37. A polymer comprising the structural unit (5)

$$(HSi)_n \qquad (5)$$

wherein n is an integer.

38. A polymer according to claim 37, wherein n is an integer of 3-1000000, preferably 10-100000, more preferably 50-50000, most preferably 200-10000.

39. A process for the production of a polymer comprising a structural unit (5)

$$(HSi)_n \qquad (5)$$

wherein n is an integer;
comprising reducing a compound having the formula (6)

$$HSiX''_3 \qquad (6)$$

wherein X'' is individually selected from the group consisting of Cl, Br and I.

40. A process according to claim 39, wherein the reducing agent is an ionic metal-containing compound.

41. A process according to claim 40, wherein the reducing agent is an ionic metal-hydrocarbon pair.

42. A process according to claim 40 or 41, wherein the reducing agent is selected from the group consisting of ionic Group I, II, XI and XIII metal-hydrocarbon compounds.

43. A process according to claim 42, wherein the metal is selected from the group consisting of Li, Na, K, Mg, Ca, Cu, Hg and Zn.

44. A process according to any of claims 41 to 43, wherein the hydrocarbon is selected from the group consisting of cyclohexenyl, benzyl, phenylethyl and phenylpropyl, phenyl, tolyl, dimethylphenyl, trimethylphenyl, ethylphenyl, propylphenyl, biphenyl, naphthyl, methylnaphthyl, anthryl, phenanthryl, benzylphenyl, pyrenyl, acenaphthyl, phenalenyl, aceanthrylenyl, tetrahydronaphthyl, indanyl and biphenylyl anions.

45. A process according to any of claims 39 to 44, wherein the reducing agent is sodium naphthalenide.